Henry Edwin Sever Institute

With flexible schedules, including evening and weekend classes, professionals can keep their careers moving while developing the knowledge and credentials that will set them apart. Our graduate students strive to make a positive impact on the challenges we face in technology, security and information management. The curriculum and course work will enhance students' knowledge and expertise. They will understand the rapidly changing marketplace and be prepared to set the pace.

Degree Programs

- Master of Construction Management (http://bulletin.wustl.edu/prior/2017-18/grad/engineering/sever/construction-management)
- Master of Cyber Security Management (http://bulletin.wustl.edu/prior/2017-18/grad/engineering/sever/cyber-security-management)
- Master of Engineering Management (http://bulletin.wustl.edu/prior/2017-18/grad/engineering/sever/engineering-management)
- Master of Health Care Operational Excellence (http://bulletin.wustl.edu/prior/2017-18/grad/engineering/sever/health-care-operational-excellence)
- Master of Information Systems Management (http://bulletin.wustl.edu/prior/2017-18/grad/engineering/sever/information-systems-management)
- Master of Project Management (http://bulletin.wustl.edu/prior/2017-18/grad/engineering/sever/project-management)
- Master of System Integration (http://bulletin.wustl.edu/prior/2017-18/grad/engineering/sever/system-integration)

Graduate Certificates

- Graduate Certificate in Construction Management (http://bulletin.wustl.edu/prior/2017-18/grad/engineering/sever/construction-management)
- Graduate Certificate in Cyber Security Management (http://bulletin.wustl.edu/prior/2017-18/grad/engineering/sever/cyber-security-management)
- Graduate Certificate in Information Systems Management (http://bulletin.wustl.edu/prior/2017-18/grad/engineering/sever/information-systems-management)
- Graduate Certificate in Project Management (http://bulletin.wustl.edu/prior/2017-18/grad/engineering/sever/project-management)
- Graduate Certificate in System Integration (http://bulletin.wustl.edu/prior/2017-18/grad/engineering/sever/system-integration)

Courses

Courses include:

- T40 SYSIN (p. 1): Systems Integration
- T55 ETEM (p. 3): Engineering Management
- T60 GSever (p. 6): General Professional Education
- T64 CNST (p. 6): Construction Management
- T81 INFO (p. 9): Information Management

Systems Integration

Visit online course listings to view semester offerings for T40 SYSIN (https://courses.wustl.edu/CourseInfo.aspx?sch=T&dept=T40).

T40 SYSIN 511 Systems Engineering and Analysis
This course covers the theory and practice of systems engineering. Students will learn the fundamentals of systems thinking, the systems engineering model, and key system engineering practices supporting the product life cycle: requirements development, trade studies, functional analysis and architecture, design synthesis, program planning, and program monitor and control. Additionally this course will cover specialty engineering integration, and students will gain a strong foundation in theory coupled with practical exercises that enhance the students' understanding of the system engineering discipline. Students must be enrolled in the MSI program or have permission from the program director to take this course. Credit 3 units.

T40 SYSIN 521 System Design and Integration
A practical examination of the later stages of the product lifecycle development through preliminary design, detailed design integration and test, system validation and verification. Analysis of physical design alternatives and applying methods from design analysis for selection of the system design. Includes design process, design disciplines and design practices. Students must be enrolled in the MSI program or have permission from the program director to take this course. Credit 3 units.

T40 SYSIN 531 System Architecture
This course will introduce the student to project profiles, timeline and capability mapping. In addition to capability considerations of the architecture, this course will include: vision, capability, taxonomy, schema, phasing, dependencies and high-level operational concepts. It will also provide the tools for developing the architecture for complex systems, along with reporting the architecture in the operational, technical and systems views. Students must be enrolled in the MSI program or have permission from the program director to take this course. Credit 3 units.
T40 SYSIN 532 Introduction to Intelligence, Surveillance and Reconnaissance
Students are introduced to fundamental ISR concepts, methods and technologies presented in a systems engineering and integration framework. This course is a high-level treatment and focuses on exploring ISR background and supporting capabilities. ISR content linking evolving domains such as net-enabled capabilities and cyber will be emphasized. Guest lecturers deliver content from disparate analytical domains, providing a broader overview of ISR activities. Case studies, readings and group discussions are used to explore analytical thinking and approaches.
Credit 3 units.

T40 SYSIN 542 Operations Analysis
Introduction to the mathematical aspects of various areas of operations research, with additional emphasis on problem formulation. This course would cover optimization to include linear programming, nonlinear programming, linear goal programming, discrete event simulation and associated statistical and probability theory. Introduction to effectiveness analysis of systems and system of systems to include engagement analysis, mission analysis, campaign analysis, system of systems optimization, network centric operations and communications analysis. Introduction to survivability, vulnerability, lethality, etc. Learn to optimize overall system performance to meet the needs of present and future organizations and operators. Apply OR techniques to perform mission, usability and cost effectiveness analysis to predict system performance and operational utility. Learn to evaluate alternatives through trade studies to balance system performance and cost while meeting customer requirements. Fundamentals of Operations Research or instructor approval are prerequisites. Students must be enrolled in the MSI program or have permission from the program director to take this course.
Credit 3 units.

T40 SYSIN 543 System Safety Engineering
System Safety Engineering is the disciplined approach to assuring the safety of a product within the context of its operation within a defined environment. The curriculum includes an overview of the discipline and a detailed review of the eight elements of system safety engineering. Among these eight elements are hazard identification, assessment of risk, identification of mitigations, and verification & validation of final design. We review traditional safety analysis methods including functional hazard analysis, common mode analysis, event tree analysis and fault tree analysis. Classroom exercises reinforce the student’s understanding of these methods. Methods discussed include those used within Defense programs as well as those used in commercial applications. Case studies, readings and group discussions are used to explore analytical thinking and approaches.
Credit 1.5 units.

T40 SYSIN 547 Reliability Engineering and Quality Processes
Reliability Engineering is the disciplined approach to assuring the reliable design and operation of a product within the context of its defined environment. The curriculum includes an overview of the discipline and a detailed review of the elements of reliability engineering. Among these elements are related disciplines that impact inherent design, sources of information that can be used to evaluate the reliability of proposed design, architecture of systems to enhance reliability, and verification & validation of final design. Additionally, the impacts of reliability on the operational use of the system will also be covered. Classroom exercises reinforce the student’s understanding of these methods. Methods discussed include those used within Defense programs as well as those used in commercial applications. Comparison of these methods and rationale for these differences will be explored.
Credit 3 units.

T40 SYSIN 551 Engineering Finance
This course will cover development cost, flyaway cost, system cost, production cost, acquisition cost, operating and support cost and total ownership cost, source of data, summary of data and estimation techniques.
Credit 1.5 units.

T40 SYSIN 556 Affordability Engineering
This course will introduce the discipline of Affordability as a fundamental element within Systems Engineering and Project Management. We will explore the application of analytical and simulation methods to better understand and predict the Life Cycle Cost (LCC) of a system/project and to balance cost, performance and risk for a system while in the development phase of its cycle. The course will cover an introduction to analysis of alternatives and cost-effectiveness trade-offs aimed at delivering best-value, market-competitive solutions to the customer. The student will discover Affordability strategies, techniques and tools used to influence decision makers and customers, and gain a competitive advantage over competitors. Students will analyze case studies exploring system trade-offs and decisions which impact the project’s value to stakeholders, Life Cycle Cost and cost risk; and effectively present their findings. Prerequisite: program director or instructor approval.
Credit 3 units.

T40 SYSIN 562 Product Lifecycle Management Overview
Product Lifecycle Management (PLM) is a disciplined Systems Engineering Management and Control process applied to a product across its lifecycle. This course will provide an understanding of the principles and techniques of PLM. The course will expose the students to the disciplines of Configuration Management, Data Management, as well as the enabling PLM Tools and Technologies. This course will also provide an understanding of PLM integration within the organization's business environment.
Credit 3 units.

T40 SYSIN 580 Capstone
One of the central priorities in Washington University's educational philosophy is the application of academic skills and knowledge to real-world problems. The capstone project represents a substantive evaluation and application of course work covered in the program. Students are encouraged to select projects with practical significance for the advancement of their company's competitive position as well as their own personal development. The project is administered, advised and evaluated by Washington University as part of the learning experience, but students are encouraged to seek mentorship from experienced colleagues in the Systems Engineering profession. The presence of, or degree of participation from, a mentor is made at the discretion of the student or the organization sponsoring the program. Students must be enrolled
in the MSI program or have permission from the program director to take this course.
Credit 3 units.

T40 SYSIN 885 Master's Nonresident

Engineering Management

T55 ETEM 310 Technical Writing

T55 ETEM 500 Independent Study
Credit variable, maximum 6 units.

T55 ETEM 502 Strategic Management of Technology
Analytical methods for strategic management are reviewed. Technology strategy is linked to the strategic plan for the organization, and methods to accomplish this linkage are developed. Factors that characterize and encourage innovation are discussed. A process for managing and integrating new technology into the strategic process is developed. Throughout the course, cases are used to analyze and demonstrate the several elements of strategic management of technology. Prerequisite: graduate standing; permission of instructor required, background or course work in presentation skills is recommended.
Credit 3 units.

T55 ETEM 503 Principles & Practice of R&D Management
The mission or role of the Research and Development (R&D) function in different types of organizations. Management of R&D personnel, including selection, development and motivation. Effective use of the dual ladder path for technical personnel. Enhancement of creativity and innovation and avoidance of technological obsolescence. Project selection and management and the improvement of R&D productivity. Factors affecting internal and external communications in R&D laboratories. Prerequisite: graduate standing; permission of instructor required.
Credit 3 units. EN: TU

T55 ETEM 511 Quantitative Methods: Engineering Mgmt I

T55 ETEM 512 Applied Stats for Engineering Management
An introduction to probability and statistical techniques applied to management and evaluation of technological systems. Hypothesis testing and estimation. Applied regression analysis and analysis of variance. Introduction to design of experiments. Credit 3 units.

T55 ETEM 513 Analytical Methods for Management and Policy Decisions
Quantitative methods commonly used in analyzing management and policy decisions. Basic concepts and applications with extensive use of case studies. Methods and applications may vary from year to year, but will typically include: economic principles involved in management and policy decisions; engineering economic analysis; cost-effectiveness analysis; decision analytic methods and modeling, including linear programming, decision theory, project management, queuing theory, inventory control, forecasting, probability concepts, risk, and utility; using laboratory and field data in decision-making; allocation of limited resources. Prerequisite: graduate standing and permission of instructor.
Credit 3 units.

T55 ETEM 521 Human Performance in Engineering
This course highlights the management of engineers, scientists and technology-based organizations; facilitated by an understanding of individual, group and organizational behavior to enhance organizational performance. Topics include: leadership, goals, motivation and performance, management of change, conflict and effectiveness, organizational development and work design.
Credit 3 units.

T55 ETEM 522 Intro to Strategic Planning & Management

T55 ETEM 522A Principles of Strategic Planning
The process of management is interwoven with strategic planning, which is developed in detail. The engineering and technology functions are linked to business policy. The strategic management process is introduced. Fundamental analytical tools for strategic decisions are addressed. Analysis of selected cases applies the conceptual framework.
Credit 3 units.

T55 ETEM 523A Project Planning and Administration
This course focuses on a holistic approach to project management, covering planning, scheduling, organizing and controlling projects. The course includes major topics of strategy, priorities, risks, project tools and organizations. Mastery of these key tools and concepts could give students a significant competitive advantage in the marketplace, as projects are used as a major tool to achieve organizational strategic goals.
Credit 3 units.

T55 ETEM 524 Managing Technical Professionals
Structure, design and theory of how to improve the effectiveness of the technical members of an organization. Nature and dynamics of conflict among technical professionals, including understanding conflict and conflict management behavior. Overview of the role of communication in creating and resolving conflicts. Effectiveness of managerial leadership in the technological organization.
Credit 3 units.

T55 ETEM 524A Executive Perspectives for Technical Professionals
Executive leadership is fundamentally dealing with human emotions and relationships. Technical and other professionals are challenged in this course to think from an executive leadership position. Being able to assess and lead other people requires balancing existing realities with new visions and moving people to these new visions. Issues addressing executive leadership include: executive competencies, consulting in executive environments, re-initiating strategic moves, leadership development, succession planning, and enterprise leadership political skills. These topics are explored through lectures, case studies, and in-class discussions with industry executives.
Credit 3 units.

T55 ETEM 533 Human Relations in Manufacturing

T55 ETEM 534A Principles of Operations Management
Examination of quantitative and managerial approaches for planning, scheduling and control of production and inventories in manufacturing companies. Review various models for demand forecasting, capacity planning, lot-sizing, scheduling, and shop-floor controls in various types of manufacturing environments. Analysis of techniques such as MRP II, JIT and Kanban in production scheduling and control.
Credit 3 units.

T55 ETEM 534B Principles of Operations Management
This course focuses on how to manage the key resources used by organizations of every type in the operation of their businesses. The operations management principles covered in this course apply to all businesses and organizations regardless of whether their output is a tangible product or an intangible service. It provides a basic understanding of the fundamental principles, systems and techniques that are the foundation of planning, organizing, scheduling and controlling the people, equipment, inventories and logistics used in business operations and serves as an introduction to, and prerequisite for, more specialized operations courses such as Lean Manufacturing, Total Quality Management, Operations Improvement, and Supply Chain Management.
Credit 3 units.

T55 ETEM 535 Productivity & Quality Control
This course provides a comprehensive coverage of quality and productivity improvement concepts for operations management. Students face realities that confront managers involved with the concurrent optimization goals of customer satisfaction and profit improvement. Theoretical and business applications are presented to provide a sound understanding of the basic principles of quality and productivity management in both a manufacturing and services business environment. The student will study contemporary management principles such as: total quality planning using the Malcolm Baldrige assessment, product reliability concepts, statistical process control, outsourcing management, customer requirements evaluation, total cost of quality assessment, productivity performance measurement and control, and others.
Credit 3 units.

T55 ETEM 537 Lean Manufacturing and Management
Lean principles and techniques will be explored and exercised to use as a competitive advantage for manufacturing and engineering-based companies. The driving force and economics of lean, supply chain management, value stream mapping, set-up reduction, Just-in-Time, managing variations, and cultural issues surrounding lean implementation are examined.
Credit 3 units.

T55 ETEM 538 Supply Chain Management
Leading organizations are increasingly leveraging their overall operations by managing integrated supply chains to realize improved strategic and competitive advantage. A supply chain system consists of all parties involved, directly or indirectly, in fulfilling a customer's request. The supply chain not only includes the producer and suppliers, but also transporters, warehouses, retailers, and customers themselves. It comprises all flows of information, product or costs within an overall acquisition, production, distribution system. Supply chain management involves the management of these flows within and between supply chain stages to maximize chain profitability for a business and its suppliers, intermediaries, customers. The course examines the three key areas: the strategic role of supply chains, the key drivers of supply chain performance, and the tools and techniques needed for supply chain analysis.
Credit 3 units.

T55 ETEM 541 Financial Accounting
Same as T81 INFO 550N

T55 ETEM 542 Engineering Economic Analysis

T55 ETEM 543 Managerial Accounting

T55 ETEM 544 Financial Analysis Engineered Facilities

T55 ETEM 550 Operations Strategy
Credit 3 units.

T55 ETEM 5501 Special Topics: Lean Manufacturing & Management
This course is an exploration of the rapidly emerging management strategies, production concepts and academic research intended to define and achieve the ideal state of lean. Lean principles and techniques will be explored and exercised to use as a competitive advantage for manufacturing and engineering-based companies. The driving force and economics of lean, supply chain management, value stream mapping, set-up reduction, Just-in-Time, managing variations, and cultural issues surrounding lean implementation are examined.
Credit 3 units.

T55 ETEM 5502 Intellectual Property and Technology
There is an increasing tension between the proliferation of information that technology brings and the intellectual property protections provided by copyright, patent and trademark law. The internet seems to be interpreted as a free-for-all where content is available for the taking and indeed, beyond the legal and moral aspect, it may be next to impossible to prevent. The international character of the internet and transparency of content location compound the problem. Whose jurisdiction? Other important legal issues related to technology abound. Some issues of corporate and personal privacy, third-party liabilities, fraud and implied warranties have case law precedent, but what changes when technology introduces nuance? Other issues such as online contracting digital signatures, electronic currency, and invasive electronic communication introduce new legal challenges altogether. This course of study is about these issues and others that face organizations reaching beyond their traditional “bricks and mortar” business practice. Taught by legal experts, it’s your chance to come up to speed with these exciting and important issues.
Credit 3 units.

T55 ETEM 5503 Special Topics: Top Ten Technologies
Same as T81 INFO 550N
Credit 3 units.
T55 ETEM 550A Creating a Competitive Advantage in Manufacturing
This course addresses fundamental principles involved for a firm to achieve a continuing competitive advantage and then relates these concepts to the development of its manufacturing strategy. The course reviews the principle elements of competitive advantage and manufacturing strategy in today's global environment. Specific focus is placed on the roles of information technology, lean manufacturing, continuous improvement, and total quality programs in overall strategy through guest lecturers, case studies and assigned readings. A blueprint for achieving world-class performance is considered through review of the Malcolm Baldrige Award criteria as a road map for continuing overall improvement.
Credit 3 units.

T55 ETEM 550B Project Management
Credit 1.5 units.

T55 ETEM 550C Designing, Managing, and Improving Operations (DMIO)
This course is aimed at students who intend to manage operations in the manufacturing and service industries. The focus is primarily on the individual operating unit, in both manufacturing and services. Case studies are the primary learning tool, addressing DMIO in three ascending levels of analysis. Module 1 addresses the design, management and improvement of the fundamental building block, manufacturing processes. Module 2 looks at the systems used to coordinate processes, focusing on the use and management of information technology. Module 3 addresses the operating unit as a whole. Credit 3 units.

T55 ETEM 550D Special Topics: Supply Chain Management
Leading organizations are increasingly leveraging their overall operations by managing integrated supply chains to realize improved strategic and competitive advantage. A supply chain system consists of all parties involved, directly or indirectly, in fulfilling a customer’s request. The supply chain not only includes the producer and suppliers, but also transporters, warehouses, retailers, and customers themselves. It comprises all flows of information, product or costs within an overall acquisition, production, distribution system. Supply chain management involves the management of these flows within and between supply chain stages to maximize chain profitability for a business and its suppliers, intermediaries, customers. The course examines the three key areas: the strategic role of supply chains, the key drivers of supply chain performance, and the tools and techniques needed for supply chain analysis. Credit 3 units.

T55 ETEM 550E Value Analysis and the Six Sigma Way
This course is an examination of value analysis and the management strategy known as Six Sigma. The discussion will examine modern theories of personal and corporate leadership, with particular emphasis on the success of organizations in industry, government and education in providing customer value and leading process improvement. Value analysis is critical in product or service development to identify the ideal function of an offering to provide value to customers. Six Sigma is then employed as a management strategy to reduce variation to provide a robust product or service. Value analysis topics will cover the basic philosophy, function analysis, FAST diagramming, creativity techniques, evaluation of alternatives, criteria analysis, and value stream mapping. Six Sigma topics include tools and methods including process flow diagrams, cause and effect diagrams, failure mode and effects analysis, gage R&R, capability studies, design of experiments and strategy for organizing Six Sigma techniques in industry. The course will cover the quality analysis methods and processes for managers and engineers in industry. Credit 3 units.

T55 ETEM 5561 Engineering Law
Legal principles and procedures relevant to engineering management and technology-based organizations. Focus on contracts, agency, government regulations, negligence, litigation, common business transactions, and trade secrets. Credit 3 units.

T55 ETEM 5562 Computers and Information Systems

T55 ETEM 5563 Technical Comm. for Engineering Managers

T55 ETEM 5563A Technical Communications

T55 ETEM 5564 Tech. Marketing Concepts
Market inputs to product research, design and development. Market research techniques for new product development in the technology-based corporation. Domestic and international marketing of advanced technology products and systems. Government procurement and contracts. Credit 3 units.

T55 ETEM 5564A Basic Marketing for Engineers and Technologists
Marketing is a business discipline that is essential to the success of any venture. This course emphasizes basic marketing principles and concepts which can be employed in achieving an organization’s goals. Equally important, this course can also help individuals develop and gain acceptance of their ideas inside their companies. The instructor brings “real-life” practical experience, knowledge and case studies to the classroom. Credit 3 units.
T55 ETEM 571 Production and Use of Financial Information
Basic concepts in collecting, organizing and using financial data for the production of income statements, balance sheets and cash flow statements. The accounting model is used to interpret and present financial data in forms for planning and controlling business activities, and for preparing project budgets and budgets for the firm. Analysis of financial statements. Prerequisite: graduate standing or permission of instructor. Credit 3 units.

T55 ETEM 574 International Technology Management
An understanding of the international economic and regulatory environment will be required for managing any enterprise now and into the 21st century. Technology development, the international macroeconomic environment, and risk factors of multinational companies are examined. Restrictions on international trade in technology developments. Selected cases are used to illustrate key influences. Prerequisite: graduate standing or permission of instructor. Credit 3 units.

T55 ETEM 583 Fin. Management for Tech. Entrepreneur
Finance for the technological entrepreneur, consultant or business manager; hands-on financial operations of the closed and public corporation; capital markets as a source of funding; present-value calculations for lease-buy decisions; corporate and personal investment as an adjunct of long-range financial planning. Prerequisite: EP 580. Corequisite: EP 571 or EP 581. Credit 3 units.

T55 ETEM 584 Technological Entrepreneurship
How the technological entrepreneur can start, manage and capitalize a small business; creating feasibility reports for new products or services; constructing the business plan; contacting venture capital sources; operational systems: personnel, marketing, financial administration, R&D, production and control. Prerequisite: senior or graduate standing or permission of instructor. Credit 3 units.

T55 ETEM 591 Marketing Communications for Technical Professionals
Starting with an understanding of the target market/audience, the course will progress through lectures, class discussion, case studies and assignments calling for the student to conceptualize, write and/or present a variety of marketing communications — plans, advertising, brochures, business letters, live presentations, etc. The student will gain practical knowledge via the 35 years of real-life marketing and writing experience of the instructor, as well as a variety of guest lecturers. Credit 3 units.

T55 ETEM 591P Beyond the Numbers - Using Financial Information Effectively
The extensive use of contemporary readings, cases and projects on financial and managerial accounting topics to give managers a fresh perspective in the analysis and interpretation of financial information for the planning and controlling of business activities, and to support business and economic decisions in a modern and ethical context. Prerequisite: E60 571. Credit 3 units.

T55 ETEM 885 Master’s Nonresident

General Professional Education
Visit online course listings to view semester offerings for T60 GSever (https://courses.wustl.edu/CourseInfo.aspx?sch=T&dept=T60).

T60 GSever 502 Financial Principles of the Company
The course is designed to a) provide incoming program enrollees with little or no finance and accounting experience or background with fundamental understanding of financial accounting concepts with an emphasis on the managerial applications of financial data, b) prepare those incoming students for the more advanced, discipline-specific courses offered later in the program and, c) give those students a grounding in financial concepts that the student can utilize as they advance to higher and more responsible leadership positions post-graduation. The course is divided into three phases. The first consists of introducing and stressing basic financial concepts, rules and principles. The second phase consists of leveraging that basic skill set to perform and evaluate analysis in the organization. The last phase will be case-study driven and will challenge the student to take the lessons of the first two phases, combine that information with already existing experience and background, and develop a business correction plan for an ailing organization. Credit 3 units.

Construction Management
Visit online course listings to view semester offerings for T64 CNST (https://courses.wustl.edu/CourseInfo.aspx?sch=T&dept=T64).

T64 CNST 523A Construction Cost Estimating
Construction cost estimating explores the application of cost estimating principles and estimating within a project management framework in conjunction with scope definition, quality control, planning and scheduling, risk management and loss prevention techniques, local conditions, information and communication, and working relations with stakeholders. Using a single building project, the course introduces the application of basic quantity surveying and estimating principles using a methodical approach with suggested check lists and techniques for arriving at a reliable cost estimate including direct, indirect, and contingency costs and profits. Student's estimating efforts culminate with a competitive bid day scenario. Prerequisites: T64-573 or permission of instructor. Credit 3 units.

T64 CNST 524 Construction Management of Public Projects
The students will examine high-level project management principles relating to the execution of public projects. The course will focus primarily on public projects but will include issues relevant to any type of large construction project. The following topics will be covered: project organization, design management, procurement, planning, estimating, project controls, real estate, politics, public involvement, contract management and labor relations. Prerequisites: senior or graduate standing.
T64 CNST 531 Construction Management of High Technology Facilities
This course will focus on the application of construction control principles for fabrication plants and other high technology manufacturing facilities. The students will learn methods used to control project scope, schedule and budget. They will gain an understanding of how to develop and define project scope including use of a funding scope statement and contract-specific (contractual) scopes of work. Students will learn techniques on supplier management such as managing supplier selection, communications, performance reviews and development. This class will involve case studies and lecture in a concentrated period — one weekend. Prerequisite: graduate standing.
Credit 3 units.

T64 CNST 538 Quality Processes In Construction Management
This course will introduce the student to the various theories of quality and provide them with the tools to apply various quality practices/principles to the construction management process. This course is designed to enable the student to enhance the effectiveness of the construction management process through application of two performance improvement methodologies...the Baldrige Criteria for Performance Excellence and Six Sigma. Graduate standing only.
Credit 3 units.

T64 CNST 540 Construction Risk Management
This course identifies the various types of risk encountered in the construction industry. Through case studies and discussions, the student will develop a deeper understanding of the principles of risk identification, assessment and management. The course focuses on administrative risk mitigation and transfer procedures, including financial and contractual risk planning, strategic safety planning, and the role insurance and bond products serve within the industry. Prerequisites: T60 502, or T64 574D, or permission of instructor is required.
Credit 3 units.

T64 CNST 542 Construction Claims
Construction Claims is designed to familiarize students with the basic foundations of the construction claims process starting with an understanding of the contractual basis for construction claims through final resolution of claims. These include a detailed survey of the various standard contracts used in the construction industry and the specific clauses that form the basis for claims; recognition of claims, the contract notice requirements, communicating the basis for claims, pricing of claims and methods for resolving claims. This will include presentation of the technical, legal and business requirements for processing claims in the construction industry. Prerequisite: graduate standing.
Credit 3 units.

T64 CNST 550A Special Topics: Sustainable Construction
The course will focus on global, national and regional sustainability issues; history of the movement; ethical issues; ecological design; legal/risks/challenges; costs of green building; national and international green building rating systems; current and potential future trends and successful practices of sustainable planning, design and construction. Also covered is how LEED Accredited Professionals manage the building certification process and documentation required for successful LEED certification. At the end of this course, students should be prepared to take the USGBC LEED Green Associate (GA) Exam Structure and have a working knowledge of the requirements for USGBC LEED v4 Specialty Exams. Additional self-study will be required after the course to fully prepare for any exam. Prerequisites: graduate standing, and CNST 573 or permission of instructor.
Credit 1.5 units.

T64 CNST 550B Special Topics in Construction Management
This course focuses on the foundational issues of securing new business while ensuring project and company profitability. Topics include creating and implementing marketing and business development strategies; customer relations management; developing competitive strategies for delivering professional construction services; bidding strategies; developing public relations strategies; managerial leadership; strategic planning. Prerequisites: CNST 573 or permission of instructor. In preparation for this course, some study materials will be provided to enrolled students approximately two weeks prior to the first meeting. Section 01: This course is being taught on two consecutive weekends.
Credit 1.5 units.

T64 CNST 550C Special Topics in Construction Management
Fundamentals of the safety management process and the use of safety programs to include hazard recognition, field safety meetings/management, OSHA documentation requirements, coordination of contractor and subcontractor relationship. Prerequisites: graduate standing, and CNST 573 or permission of instructor.
Credit 1.5 units.

T64 CNST 550D Special Topic: Heavy Civil Construction Management
This course provides a broad perspective of the means, methods and procedures associated with managing civil engineering and heavy construction projects. Topics include strategic bidding and estimating, heavy equipment, marine construction heavy civil operations and bridge building. Integration of scheduling, estimating, and construction contracts with a project-based approach. (Three half-day Saturday site visits are required.) Prerequisites: graduate standing, and CNST 573 or permission of instructor.
Credit 3 units.

T64 CNST 572 Legal Aspects of Construction
A survey of the legal problems of the construction manager, including but not limited to, liability in the areas of contracts, agency, torts, insurance, bad judgment and oversight. Prerequisite: graduate standing.
Credit 3 units.

T64 CNST 573 Fundamentals in Construction Management
In this course, students will be exposed to the overall construction process from initial concept through startup of the completed facility. The focus is to provide familiarization of the construction and contracting process and potential involvements by construction managers in the planning, design, construction and post-construction phases. Additional topics are introduced to provide a foundation which will prepare...
students for future construction management course work. Case studies and industry examples are used throughout the course to authenticate the lectures and assignments. Prerequisite: graduate standing. Credit 3 units.

**T64 CNST 574C Construction Project Planning and Scheduling**

Project planning and scheduling process utilizing current techniques including critical path analysis for effective and logical scheduling of construction projects. Identification of project activities and their relationships; schedule development, analysis and updating; relationship of project costs and resources to the schedule; legal implications; effective communication of schedule information; development of procedures to monitor actual field progress; computer application in project scheduling. Prerequisites: T64-573 or permission of instructor. Credit 3 units.

**T64 CNST 574D Finance & Accounting**

General business accounting and financial principles adapted to the construction industry will be presented. All key financial management principles required by construction managers will be addressed. Material will be presented on how to manage costs, profits and cash flow for construction companies and how to quantitatively analyze construction-related financial decisions. Prerequisite: graduate standing. Credit 3 units.

**T64 CNST 575 Construction Internship**

The student will be placed in an actual construction environment for a period of about 2 1/2 months. This program is a cooperative activity between the St. Louis Section of the Associated General Contractors of America and Washington University. The student will have an opportunity to utilize the knowledge and experience gained from previous class work and to be closely associated with the modern construction industry. All work done by the student will be monitored by the specific company involved and Washington University. The student will be required to submit a detailed report on a specific subject that will be determined by the faculty and the student. Prerequisites: CE 574, enrollment in Master of Construction Management or Construction Engineering Option - Master of Structural Engineering Program and permission of instructor. Credit 3 units.

**T64 CNST 577A Project Cost and Resource Analysis and Management**

This course will build on the scheduling and management skills learned in CNST 574C Construction Project Planning and Scheduling and introduce the student to project cost and resource management techniques. The power and validity of Critical Path Management (CPM) to manage construction projects will not be fully utilized when only considering the element of time. The other key metrics that must be managed with respect to time are the project activities' cost and the resources required to accomplish the defined work. The ability to understand and manage a project's three critical metrics: Time, Cost and Resources must be sound prior to applying the most powerful project management tool — Earned Value Management. Earned Value Management will be explored in detail in a separate course. The focus of this course will be more technical in nature and reinforce how cost and resource information is managed using Primavera P6. This course will use real-world case studies to explore these techniques. Prerequisites: CNST 574C, proficiency in Primavera P6, or permission of instructor. Credit 1.5 units.

**T64 CNST 577B Earned Value Analysis**

Earned Value Management (EVM) is a powerful management tool that, when used in conjunction with a resource and cost loaded Project Master Schedule, empowers the project manager to quantitatively compare the planned amount of work at a point in time with that which has actually been completed, ergo, earned. Earned Value Management, when applied properly, yields a level of confidence in the accuracy of key project metrics such as percent-complete, revenue forecasts, budget performance and schedule performance that Critical Path Management will not provide on its own. This course will explore the theory and mechanics of Earned Value Analysis and how the data is used for Earned Value Management. This course will explore the principles of EVM and study how this management tool is used and applied in Primavera P6 scheduling software. The focus of this course study will be on real-world case studies rather than stand-alone examples and problems. Prerequisites: CNST 574C, CNST 577A, proficiency in Primavera P6, or permission of instructor. Credit 1.5 units.

**T64 CNST 579 Advanced Construction Management**

A comprehensive study of the operations encountered in the management of a construction firm. Topics include: estimating, scheduling, forms of contracts, risk analysis and management, extra work orders, claims and disputes, construction safety, and contract close-out. Prerequisites: T64-573, T64-574, T64-523A, and permission of program director. Credit 3 units.

**T64 CNST 580A Construction Technology**

A comprehensive study of the core construction methods and practices used on the job site today. Emphasizes the types of construction materials, technologies and applications available to the contractor, their use and function on the project, and the importance and interrelationship of these factors to the success of the construction project delivery. (Saturday site visits required.) Credit 3 units.

**T64 CNST 580B Digital Construction Technology**

This course focuses on BIM’s philosophy of integration between designers, construction professionals and owners, in order to overcome both technological and implementation changes using Virtual Design and Construction (VDC) and Integrated Project Delivery (IPD). VDC is a methodology that relies on a multidisciplinary collaboration of the digital simulation of design & construction. IPD, on the other hand, integrates people, systems, business structures and practices into a process to optimize efficiency and productivity. In this course, students will learn about BIM’s application by exploring 3-D, 4-D aspects of BIM including geometry, spatial relationships, quantity take off, estimation and scheduling. Along with that, students also will learn about Virtual Design and Construction (VDC) and Integrated Project Delivery (IPD) systems that are integral components of successful BIM projects. Credit 3 units.
T64 CNST 581A MCM - MArch Capstone Project Phase 1
This capstone course allows MCM/MArch joint degree program students to apply constructability principles to their MArch degree project (A46 ARCH 616) and successfully demonstrate how they have applied those principles. Constructability principles include: analysis of the construction methods and procedures, project cost, time, value, quality and safety. Phase 1 is to be taken simultaneously with A46 ARCH 616 Degree Project. Phase 1 students will develop a constructability review, analysis and plan for their individual project. Prerequisites: admission to MCM/MArch joint program, CNST 573, 523A, 574C. Credit 1 unit.

T64 CNST 581B MCM - MArch Capstone Project Phase 2
This capstone course allows MCM/MArch joint degree program students to apply constructability principles to their MArch degree project (A46 ARCH 616) and successfully demonstrate how they have applied those principles. Constructability principles include: analysis of the construction methods and procedures, project cost, time, value, quality and safety. Phase 2 is to be taken after completing A46 ARCH 616 Degree Project. Phase 2 students will execute the constructability plan developed in Phase 1 and prepare and present the deliverables. Prerequisite: CNST 581A. Credit 2 units.

T64 CNST 885 Master’s Nonresident
T64 CNST 887 Graduate Certificate Nonresident
For graduate-level students who are seeking only a graduate certificate (i.e., and are not pursuing any master's or doctoral program). Registration into this course is for semesters when the student is nonresident to the university campus but is still technically actively involved in communications with department and faculty, as needed, to continue certificate program. Fulfills continuous registration requirement.

Information Management
Visit online course listings to view semester offerings for T81 INFO (https://courses.wustl.edu/CourseInfo.aspx?sch=T&dept=T81&crsrlv=5:8).

T81 INFO 500 Independent Study
Prerequisite: departmental approval. Credit 3 units.

T81 INFO 501 Information Systems Technology
T81 INFO 501A Technology of Information Systems I
T81 INFO 501B Information Technology
Review of the major platforms of computing mainframe, mid-range and micro. Examine computing platforms emphasizing applicability in specific circumstances. Emphasis on operating systems software, telecommunications, and client server computing. Credit 4 units.

T81 INFO 502 Database Management
T81 INFO 502A Technology of Information Systems II
T81 INFO 502B Applied Information Technologies
This course reviews a variety of broadly applied information technologies. Technologies reviewed include database, data modeling, data warehousing, object-oriented programming and design, Electronic Data Interchange (EDI), systems and application architecture, managing systems, e-commerce and Graphical User Interfaces (GUIs). How these technologies help provide specific information solutions will be covered. Credit 4 units.

T81 INFO 502C Systems and Application Architecture
This course reviews a variety of broadly applied information technologies. Technologies reviewed include database, data modeling, data warehousing, object-oriented programming and design, systems and application architecture, managing systems, e-commerce, Electronic Data Interchange (EDI), Imaging, and Graphical User Interfaces (GUIs). How these technologies help provide specific information solutions will be covered. Prerequisite: T81-501C. Credit 4 units.

T81 INFO 503 Management Information Systems
T81 INFO 503A Info Technology Delivery in Organization
T81 INFO 503B Organizational Dynamics of Tech Assimilation
Examination of organizational implications of information technology. Topics include assimilation and diffusion of technology; the effects of technology on organizations and organizations on technology; and how to analyze organizations to assess the role of information technology. Credit 4 units.

T81 INFO 503D Applying Innovations within Organizations
This course focuses on how innovations, such as new technologies, find their way into organizations through managerial approaches. Topics will include assimilation and diffusion of technology, effects of technology on organizations and organizations on technology, and how organizations may be analyzed to assess the role of innovations. Emphasis will be placed on how to understand the organization's social system and what can be done to prepare it for an innovation. Disruptive technologies, organizational culture, and how organizations change will also be covered. Prerequisite: appropriate background. Credit 3 units.
T81 INFO 504 Computer & Information Systems Management

T81 INFO 504A Computer & Info Systems Management

T81 INFO 504B Managing Information Technology
This course reviews major issues dealing with managing information technology in the enterprise. Topics covered include aligning I/S with corporate goals, strategic planning, technology resource selection/acquisition, IT architecture and infrastructure, outsourcing and managing IT-driven change. Prerequisite: T81-503B. A group problem consisting of working on an industry problem is required. Credit 4 units.

T81 INFO 504C Practical Management of Information Technology
This course reviews major issues dealing with managing information technology in the enterprise. Topics covered include aligning I/S with enterprise goals, strategic planning, outsourcing, IT architecture and infrastructure, acquisition of resources; managing IT-driven change; evaluating IT investments and security. A group problem consisting of working on an industry problem is required. Prerequisite: T81-503B. Credit 4 units.

T81 INFO 504D Management of Information Technology
This course reviews major issues dealing with managing information technology in the enterprise. Topics covered include aligning I/S with enterprise goals, strategic planning, outsourcing, IT architecture and infrastructure, acquisition of resources; managing IT-driven change; evaluating IT investments. A group problem consisting of working on an industry problem is required. Credit 3 units.

T81 INFO 505 Managerial Computing

T81 INFO 505A Managerial Computing
The course is meant to provide a broad understanding of computing technology as an area of substantial managerial concern. A survey of computing technologies as used in business/government enterprises is provided. Conceptual foundations for information and systems are covered, along with a review of how application information systems are constructed within complex environments. Credit 3 units.

T81 INFO 506B Foundation of Information Management
This course lays out the foundations for information management through coverage of frameworks for understanding the place information management holds in an enterprise. These frameworks come from a broad background of managerial thought and other related disciplines. Key conceptual foundations are covered, computing and telecommunications technologies are surveyed, and development and support of information systems are reviewed. Recent research contributions dealing with information systems practice along with organizational and social context of information systems are covered. Credit 3 units.

T81 INFO 507 Contemporary Issues in Information Sys.

T81 INFO 507A Seminar in Contemporary Information Technology Issues
The focus of this course will be where the study and practice of information technology is headed. This will include discussions of legal, ethical, and privacy issues concerning information technology. Also a review of recent topics in software development, metrics, re-engineering and quality assurance will be covered. The student will benefit most from this course after having completed the MIM core, or by having substantial practical experience in the information technology field. Credit 3 units.

T81 INFO 507B Seminar in Information Management and Enterprise Transformation
The modern enterprise relies heavily on information management. As enterprises transform to keep pace with business realities such as globalization, mergers/acquisitions, and proliferation of new business models, management needs to reconsider technology infrastructures, social infrastructures, re-engineering business processes, outsourcing, and measuring/managing technology knowledge. The roles of CIOs and IT professionals, power teams, and leadership issues concerning change will be covered. Credit 3 units.

T81 INFO 507C Seminar in Information Management and Enterprise Transformation
The modern enterprise relies heavily on information management. As enterprises transform to keep pace with business realities such as globalization, mergers/acquisitions, and proliferation of new business models, management needs to reconsider technology infrastructures, social infrastructures, re-engineering business processes, outsourcing, and measuring/managing technology knowledge. The roles of CIOs and IT professionals, power teams, and leadership issues concerning change will be covered. Credit 3 units.

T81 INFO 507D Information Management and Enterprise Transformation
The modern enterprise relies heavily on information management. As enterprises transform to keep pace with business realities such as globalization, mergers/acquisitions, and proliferation of new business models, management needs to reconsider technology infrastructures, social infrastructures, re-engineering business processes, outsourcing, and measuring/managing technology knowledge. The roles of CIOs and IT professionals, power teams, and leadership issues concerning change will be covered. Credit 3 units.

T81 INFO 508 Sem in Automated Development Environment

T81 INFO 508A Principles of Auto Development & Case

T81 INFO 508B Principles of Auto Development & Case
Introductory concepts of Automated Development (AD) are presented. Various models of AD are reviewed in detail (e.g., Information Engineering), methodology assessment approaches are covered (e.g., Process Maturity), and a variety of organizational interpretations of technology impact are surveyed. The technology of Computer-Aided Software Engineering (CASE) will be covered through tutorial laboratory sessions and a small laboratory problem assignment. Credit 3 units.

T81 INFO 508C Enterprise Systems Development Architectures
This course defines the architectural requirements for any systems development effort. Different alternatives are presented which represent various methods to design an enterprise IT architecture that will integrate the back office processing with the front office presentation requirements, regardless of the
target. Designing an architecture that meets the e-business requirements of an organization while maintaining the integrity of the transactional-based systems is examined within this framework. Emphasis is placed on implementation choices that will provide the flexibility of a dynamic e-business environment while providing the continuity necessary to achieve a relatively stable application development environment.
Credit 3 units.

T81 INFO 509 Principles of Project Mgmt for Ent Info

T81 INFO 509A Software Project Mgmt. in Organization
This course covers project management principles for software system development. It includes discussions of alternative project management approaches and concepts, and how to choose between them when managing a project. The focus of this course is a parametric analysis of a project so its complete environment becomes manageable. A lab experience with a project management tool will also be provided.
Credit 3 units.

T81 INFO 509B Managing Teams and Projects
Establishing a personal leadership style, assessing people, and recognizing/establishing authority on a project will be covered. Handling project meetings and dealing with key stakeholder communication will be given emphasis. Teamwork will be highlighted through discussion of various kinds of teams, team structure and team formation. The virtual team style will also be reviewed.
Credit 3 units.

T81 INFO 510 Technical Writing for Professional Publications
This course provides a means to communicate the technical knowledge gained in MSIS & MIM courses in a manner suitable for submittal to a technical conference, such as the IEEE or other technical society. Having a portfolio of publications is a significant benefit to any resume, especially in industry and academia. Furthermore the ability to communicate through formal, technical writing complements the skills gained in electronic mail, social media, etc., whenever a paper or proposal is requested to present one's ideas and influence some action through the art of persuasion.
Credit 1.5 units.

T81 INFO 511 Info Sys Technology (at U of Tilburg)

T81 INFO 511A Technology of Info Systems I

T81 INFO 511B Tech of Info Systems II (at U of Tilburg)

T81 INFO 512 Database Mngt & Design (at U of Tilburg)

T81 INFO 512A Technology of Information Systems III

T81 INFO 513 Mntg Info Systems (at U of Tilburg)

T81 INFO 513A Information Technology in Organizations

T81 INFO 514 Cmtr & Info Sys Mngt (at U of Tilburg)

T81 INFO 514A Computer & Info Systems Mgmt I

T81 INFO 514B Computer & Info Systems Mgmt II

T81 INFO 515 Global Info Strategy & Systems Planning

T81 INFO 516 Localized Information Analysis

T81 INFO 516A Information, Engr Planning & Analysis
This course describes the corporate IS requirements assessment and planning process. It covers the development of an information architecture and a technology architecture. An enterprise model is discussed from the aspects of subject areas, entities and processes. Details concerning data analysis are covered and include data entities, entity attributes, entity relationships, and macro/micro data modeling. Diagramming tools for data modeling will be used. Details of process analysis are covered, and tools will be used for hierarchical decomposition, data flows and action diagrams. Prerequisite: T81-509B.
Credit 3 units.

T81 INFO 516B Principles and Practice of Information-Systems Engineering Analysis
This course describes the corporate IS requirements assessment and planning process. It covers the development of an information architecture and a technology architecture. An enterprise model is discussed from the aspects of subject areas, entities and processes. Details concerning data analysis are covered and include data entities, entity attributes, entity relationships, and macro/micro data modeling. Diagramming tools for data modeling will be used. Details of process analysis are covered, and tools will be used for hierarchical decomposition, data flows and action diagrams.
Credit 3 units.

T81 INFO 516C Enterprise Systems Development Methods and Framework
This course investigates alternative approaches to system development that support various business models (including eBusiness) and commonly utilized standards (e.g., the capability maturity model). Designed around the SDLC framework, alternative development methods are compared in order to identify which approaches can be exploited to achieve the best result given the functional requirements of the system under consideration. A comprehensive case analysis will be included. Credit 3 units.

T81 INFO 517 Service Management
This course focuses on the IT service life cycle and its value to the business. This in-depth study of service strategy, service design, service transition, and service operations will provide the student with an understanding of the 26 IT Infrastructure Library (ITIL) processes. Through the application of continuous service improvement, students will understand the IT service life cycle and will also be able to assess the effectiveness of processes and services. This course includes case studies, lectures and group activities to enhance the textbook material.
Credit 3 units.
T81 INFO 517A I E Design and Construction
This course covers preliminary design, presentation architecture, communications architecture, data architecture, process architecture and application construction. It includes discussions of techniques and tools for defining menu structures, screens and screen dialogues, and user interface management systems. It discusses the communications environment and protocol. Logical and physical database design are covered. General principles of physical design are discussed, such as module definition, coupling and cohesion, and module packaging, with an emphasis on related diagramming tools. Finally, physical limitations and their effect on implementation of the design are debated. Credit 3 units.

T81 INFO 517B Principles and Practice of Information-Systems Engineering Design and Construction
This course explores the design and system implementation stages of the system development life cycle (SDLC). Information engineering, object-oriented and graphical user interface design concepts are covered; diagramming tools are used for system flow, procedural logic and window layouts. Concepts in distributed systems design are introduced. Coding, testing, installation and organizational issues in system implementation are discussed. Prerequisite: T81-516. Credit 3 units.

T81 INFO 518A Information Engineering Project
All the fundamental aspects of information engineering are used on a semester-long laboratory project. Students will work in teams to solve an information problem from planning to implementation. Advising sessions will be conducted throughout the semester, and specific deliverables will be reviewed as the project reaches completion. Prerequisite: T81-517A. Credit 3 units.

T81 INFO 519 Information Engineering (at U of Tilburg)
Engineering is a continuing area of growth. New topics such as encyclopedia management, graphical user interface, and object-oriented techniques will be covered. The automated tool market will be discussed, and how information engineering is being assimilated into current business environments. Credit 3 units.

T81 INFO 519A Advanced Topics in Information Engineering
Information engineering is a continuing area of growth. New topics such as encyclopedia management, graphical user interface, and object-oriented techniques will be covered. The automated tool market will be discussed, and how information engineering is being assimilated into current business environments. Credit 3 units.

T81 INFO 520 Decision Support Systems and Executive Information
This course will introduce the student to the decision support system (DSS) arena. While actual DSSs will be designed and developed by the student, the course is not technically oriented. Rather, much of the course discusses DSS subject matter from a general management and organizational perspective. Topics covered include management decision making, models/statistics, and DSS design and development, as well as more specialized topics such as group DSS, executive information systems and expert systems. As part of the course, students will have the option of working with their organization in the development of DSS. Credit 3 units.

T81 INFO 520B Management Support Systems
This course is a survey of tools, technologies and applications used to support management processes and to provide intelligence about the state of the business. Topics covered include decision support systems, groupware, executive support systems, the corporate data warehouse, online analytic processing, expert systems and geographic information systems. Case studies and industry speakers highlight strategies for successful implementation of this class of system. Opportunities are provided for students to have hands-on experience with a variety of tools. The only technical expertise assumed is exposure to spreadsheets and the WWW. Credit 3 units.

T81 INFO 521 Enterprise-wide Information Management
The deployment of information technology within the enterprise is an increasingly more complex organizational problem. The disaggregation and dispersion of technology throughout the enterprise, combined with the increasing value of information to managers and workers, creates a dynamic and important management problem. The course considers a broad set of frameworks for dealing with the problems, and offers a number of case studies taken from U.S. and European companies. A prime focus is the linkage between the enterprise management culture and the information technology frameworks. Topics include high-performance information management, information economics, enterprise-wide action planning, organizationally aligned I/T management, and organizational and process I/T architectures. Credit 3 units.

T81 INFO 527 Introduction to Big Data, Business Process Modeling and Data Management
This course is designed to introduce basic concepts of “Big Data” and the impact these technologies have on society and the enterprise. The course will describe various types of practical “Big Data” implementations, but will focus on the business value that such technologies may allow the enterprise, as well as the risks that can arise from managing the large volume of data that new technology allows. The course will cover a broad spectrum of data fundamental terms, definitions, historical perspectives, and current trends with a focus on big data as a business consideration in an ever-changing world of technological advances and business needs. The course will introduce key big data concepts and terminology that will allow both the business leader and the technical engineer the ability to converse in terms relevant to both disciplines. This course is expected to raise the general awareness of business and technical professionals about the threats, risks and control needs in the cyber-evolving world around them and provide a road map for big data implementations and projects in small and large enterprises. Credit 3 units.

T81 INFO 531 Intro to Telecommunications Technologies
in an integrated SAP environment. The exercises provide a guide through the concepts and creation of applications supporting the business functions of the company. Credit 3 units.

T81 INFO 5502 The Art and Science of Risk Management
This course focuses on why many project managers miss requirements for schedule, budget or even both. The course concentrates on key risk management techniques practiced by leading project and program managers and taught through fact-filled lecture, case work and project execution as applied to information systems, engineering, finance, product/process and design projects/programs in today’s fast-moving environment. Students will take away key value propositions including risk identification, risk quantification, risk monitoring, risk control and risk mitigation. This course will enable the student to address common scope, schedule, quality and cost risk events that occur on complex projects. Project risk management examines the types of risk, with a focus on understanding the process of risk identification, assessment, prevention, mitigation and recovery; governance, auditing, and control of the confidentiality; integrity; and availability of data. Using common operational, strategic, tactical, and technological scenarios, the course work provides a comprehensive approach to the challenges faced by managers where global data is readily available, risk is pervasive, regulations are ever-increasing, and the threat of disruption from potential crises is real. Credit 3 units.

T81 INFO 5503 Developing Leadership for Professionals
Provides knowledge about a variety of leadership approaches and how they may be effective in technological situations. The course concentrates on developing skills to actually lead in various situations. These include decision-making, problem solving, coaching, evaluating performance, selling ideas, and gaining commitment. Combines classroom, actual experiences, and reality-based feedback to hone skills resulting in a higher ability to lead. Credit 3 units.

T81 INFO 5504 Project Management Fundamentals
A practical orientation for using what is known about organizations and how to apply this knowledge to managing projects. Review of the project management paradigm, the basic ingredients of a project, critical stakeholders and roles, and the normal project life cycle will be provided. An introduction to the project management mastery model is covered along with explanations for ways to integrate current and future knowledge into the model. How project approaches should differ by how to segment the problem space — monolithic, incremental or evolutionary. Credit 3 units.

T81 INFO 5505 Project Management Standards
The course covers the disciplines and intellectual processes that are generally accepted in the application of sound management principles to projects. The course provides an extensive review of the Project Management Institute's (PMI) A Guide to the Project Management Body of Knowledge (PMBOK). Included will be a detailed review of the nine knowledge areas and five process groups of the PMBOK as well as related material considered essential for a Project Management Professional (PMP). The emphasis is on the common management practices and processes for all projects. This course qualifies for
the training prerequisite for the PMP examination, and will include discussion of the process to prepare for and take the examination. Other frameworks will be discussed such as the capability maturity model, six sigma and ISO 9000. Simulation exercises will be provided along with a review of the mastery model for project management. Prerequisite: T81-5504 or T55-523A. Credit 3 units.

T81 INFO 5506 Group Dynamics in Project Team Performance
This course examines how teams actually work, looking at group behavior in social situations and how various leaders perform in these social situations. Group motivations of teams are also examined in light of the local situation and/or a large enterprise. Identifying the enabling conditions for team formation and the importance of context to team performance. The idea of a standard normal person and how it relates to team behavior. Subject areas covered include: groupthink and the impact on projects; social facilitation with key stakeholders; project uncertainty and the dynamics of contribution; project and organizational climate. Prerequisite: T81-509B. Credit 3 units.

T81 INFO 5507 Strategies of Projects, Programs and Portfolios
This course addresses the strategic alignment and prioritization of multiple and complex projects with an organization’s business objectives and directions. Major areas covered include: stakeholder value, return on investment, balancing the trade-off between project priorities and operational imperative business benefit; establish and implement program governance of multiple projects to ensure consistent alignment with organizational strategy; balancing and coordination of project resources across multiple projects; coordination of schedules among multiple projects using traditional and advanced methods; current trends and practices in program and project portfolio management. Prerequisite: T81-5504. Credit 3 units.

T81 INFO 5508 Advances in Project Management
This course examines various aspects of organizations and project performance from actual cases. Aspects include the project decision making environment, the enterprise culture, leadership attributes, changes due to project creativity, logic of reasoning within a project and how projects are actually learning environments. Credit 3 units.

T81 INFO 550A Reviews of Technology Assimilation
Consult department. Registration by departmental permission only. Credit 3 units.

T81 INFO 550B The Internet as a Communication Tool
This is a special topic course dealing exclusively with the internet, including what the internet is and how it can be utilized to help you regardless of your profession. The course not only discusses possible professional use, but also discusses and provides the basic tools and where to find tools that allow the student to maximize the internet for their specific professional requirements. Each course topic will bring ample internet references to support lecture notes and the professional needs of the student. When possible, live hook-up to the internet will be utilized. Credit 3 units.

T81 INFO 550C Special Topics: Intro to Data Warehouse Design
The course provides an introduction to data warehouse design concepts. Topics in data modeling, database design and database access will be reviewed. Issues in data warehouse planning, design, implementation and administration will be discussed in a seminar format. Students will complete a project in data warehouse design. Credit 3 units.

T81 INFO 550F Special Topics: Human Computer Interface Design
What constitutes an effective interaction between humans and the computer systems they use? Usability is the quality of a system or product that makes it easy to learn, easy to use, error tolerant and satisfying to the user. It plays a role in effective performance of tasks, product success or failure, and workforce productivity. This course covers the characteristics of effective human-computer interactions. It reviews human-centered design methodologies that result in usable software and websites. It includes information about building a business case for usability, as well as evaluating and testing product usability. Credit 3 units.

T81 INFO 550G Special Topics: Professional Project Management
This course covers the disciplines and intellectual processes which are generally accepted in the application of sound management principles to projects. The course is oriented toward the Project Management Institute’s (PMI) Book of Knowledge (PMBOK). It includes a detailed review of the nine knowledge areas and six process groups of the PMBOK as well as related material considered essential for a project management professional (PMP). The concepts and their practical application, while essential knowledge for those seeking to gain a PMP certification, are foundational for any information management professional or consultant. The emphasis is on the common management practices and processes for all projects. For those professionals seeking their PMP certification, this course qualifies for the training prerequisite for the exam, and will include discussion of the process to prepare for and take the exam. Credit 3 units.

T81 INFO 550N Special Topics: Top Ten Technologies
Credit 3 units.

T81 INFO 550S Introduction to Biomedical Informatics
The purpose of the course is to increase students’ understanding of the challenges in life sciences and ways that problems are being addressed using information technology. Students will be exposed to various topics involved in the application of information technology to biomedical disciplines. Topics covered will span biological processes and problems through practices and issues in clinical care. Drug discovery and development will also be covered. Students will have a better foundation in biomedical issues in order to be able to more effectively apply information technology where it can make a difference. Prerequisites: senior or graduate standing, expertise in the
application of information technology. Basic to intermediate understanding of biology and medicine. Credit 3 units.

T81 INFO 551 Special Topics: Perspectives on Computers

T81 INFO 5510 Special Topics: Business Ethics in Project Management
An applied ethics course designed to recognize dilemmas by analyzing realistic and relevant case studies involving managers in various segments of industry. Studies include philosophical foundations of ethical decision making; application of various models to resolve del applications and the development of ethical dilemma resolution. Particular emphasis will be placed on developing tools for problem-solving and decision-making. To grasp ideas and principles as they have been spelled out in a variety of traditional ethical systems and to apply these conceptual structures and guidelines to problems and dilemmas of project managers. Special emphasis will be placed on tools for problem-solving and decision-making. Credit 3 units.

T81 INFO 556 Advanced Risk Analysis and Response Planning
This course develops mastery-level skills to allow the risk practitioner to focus on meeting threat and opportunity uncertainty challenges in rapidly changing project and business environments and on developing competencies needed for the future project and portfolio success. Advance application of quantitative risk analysis, dual contingency analysis, advanced decision analysis, risk valuation, and risk data accuracy/precision are covered. Advanced contingency planning with predictive analytics will be included. Key business environments that would leverage these competencies include information technology, cyber security, engineering, manufacturing, procurement and financial services. Focus areas of discussion include: 1. Expose risk practitioners to advanced risk response planning for threat avoidance, mitigation and transferring risk to appropriate stakeholders. Advanced response planning for exploiting, enhancing and sharing opportunities will be addressed. 2. Critical decision analysis incorporating risk will be covered. Key risk management capabilities and trends that affect organizations in the 21st century — cyber security, financial uncertainty, global management, entrepreneurship, employee competency risk, team-based management and managing risk threats and opportunities in a competitive and ethical manner — will be examined. 3. Develop competency at predicting the likelihood (probability) and consequence (impact) associated with risk events. This includes determining how project outcome can be affected by known and unknown risks. Prioritization and valuation of multiple risks; determining project risk scores to aid in portfolio analysis, strategic capital allocation and maximizing alignment to business strategies. 4. Expanded quantitative analysis including asymmetrical, symmetrical and uniform probabilistic distribution scenarios. This will include expanded Monte Carlo simulations to predict risk probability of project completing according to baseline schedule, cost, and likelihood of risk occurrence. Expanded decision tree analysis, annotations and calculations will be mastered. 5. Learn how to develop detailed and proactive risk triggers indicative of pending risk event occurrence. Development of secondary risk, contingency plans and fallback plans will also be included. 6. Practical methodology of decision analysis and alternative evaluations of multiple options to select course of action with most probable success and crisis avoidance. Use of Monte Carlo analysis and decision tree analysis will be covered to address risky decisions facing key leaders. Innovation-based risk analysis will be discussed for leading edge technology, cyber and software applications. 7. Current risk certification requirements, corporate application and value proposition for CISSP, PMI-RMP®, etc., will be examined. 8. Threats and opportunities related to corporate procurement applications will be presented for application in outsourcing, contracts, joint ventures/acquisition activities, etc. Credit 3 units.

T81 INFO 557 Privacy in the Digital Age
The reduction of the cost of storing and manipulating information has led organizations to capture increasing amounts of information about individual behavior. New trade-offs have emerged for parties involved with privacy-enhancing or intrusive technology. Individuals want to avoid the misuse of the information they pass along to others, but they also want to share enough information to achieve satisfactory interactions; organizations want to know more about the parties with which they interact, but they do not want to alienate them with policies deemed as intrusive. Is there a “sweet” spot that satisfies the interests of all parties? Is there a combination of technological solutions, economic incentives, and legal safeguards that is acceptable for the individual and beneficial to society? Privacy is a complex and multifaceted concept. This course combines technical, economic, legal, and policy perspectives to present a holistic view of its role and value in the digital age. It begins by comparing early definitions of privacy to the current information-focused debate. It then focuses on: technological aspects of privacy (privacy concerns raised by new IT such as the internet, wireless communications and computer matching; tracking techniques and data mining; privacy enhancing technologies and anonymous protocols); economic aspects (economic models of the market for privacy; financial risks caused by privacy violations; the value of customer information); legal aspects (laissez-faire versus regulated approaches; US versus EU legal safeguards); managerial implications (the emerging role of chief privacy officers; compulsory directives and self-regulative efforts); policy aspects (trade-offs between individual privacy rights and societal needs). The course will consist of a combination of readings, assignments and class discussions. Assignments will include essays and technical projects. Credit 3 units.

T81 INFO 558 Applications of Deep Neural Networks
Deep learning is a group of exciting new technologies for neural networks. By using a combination of advanced training techniques of neural network architectural components, it is now possible to train neural networks of much greater complexity. This course will introduce the student to deep belief neural networks, regularization units (ReLU), convolution neural networks and recurrent neural networks. High performance computing (HPC) aspects will demonstrate how deep learning can be leveraged both on graphical processing units (GPUs), as well as grids. Deep learning allows a model to learn hierarchies of information in a way that is similar to the function of the human brain. Focus will be primarily upon the application of deep learning, with some introduction to the mathematical foundations of deep learning. Students will use the Python programming language to architect a deep-learning model for several real-world data sets and interpret the results of these networks. Credit 3 units.
T81 INFO 560 Cyber Security & Info Assurance
Information security is paramount to the health of a successful enterprise. Learn what it takes to manage and operate an information security program in an enterprise. The focus is on areas such as risk assessment, risk management, incident handling and business continuity planning. Learn the vocabulary, vernacular and terminology used in the information security space. Learn what keeps chief security officers, their teams and the business clients they serve "awake at night," and what you can do, as an information security professional to protect your clients.
Credit 3 units.

T81 INFO 561 A View from the Bridge: Leading an Information Security Team
This class discusses the "How-To's" in developing, organizing, staffing and leading an information security organization from inception through maturity. How it is supported by the CSIS Top 20 Critical Controls will also be a focal point of the course. We will discuss how to manage the harmony between regulatory standards, information security best practices, and organizational practices and procedures in establishing and leading an effective cyber security organization. "Because organizations and their information systems constantly change, the activities within the security management process must be revised continuously, in order to stay up-to-date and effective. Security management is a continuous process and it can be compared to W. Edwards Deming's Quality Circle (Plan, Do, Check, Act)." (Control Case International 2012). Students will study initial security policies that stipulate requirements about ethics, confidentiality and integrity. Techniques for implementing and technical controls for enforcing these policies are investigated, including access control mechanisms, user authentication, configuration and vulnerability management techniques, and networking tools such as firewalls and intrusion detection systems. This course explores, more deeply, the principles of information technology governance, focusing on IT control objectives (COBIT) and related internal controls. Course work provides a deeper understanding of best practices for managing cyber security processes and meeting multiple needs of enterprise management by balancing the void between business risks, technical issues, control needs and reporting metrics.
Credit 3 units.

T81 INFO 562 Threat Intelligence & Intrusion Incident Management
This course will provide the student with a basic understanding of information warfare. This course will build from a strategic understanding of warfare as reflected in the information realm. It will discuss both theoretical and practical aspects of dealing with information warfare. Included will be a discussion of how information warfare differs from cyber-crime, cyber-terrorism and other forms of online conflict. The course will equip the student with the current practices in detecting and mitigating incidences and the communication strategies to employ in educating not only senior management but also the employee body at large. Included will be best practices to design and implement an employee awareness campaign on incidence response.
Credit 3 units.

T81 INFO 567 Enterprise Network Security
Some of today's most damaging attacks on computer systems involve the exploitation of network infrastructure, either as the target of attack or as a vehicle to advance attacks on end systems. This course provides an in-depth study of the ITIL methodology in securing the network against various attack techniques. It will explore ITIL methods to defend against them. Topics include firewalls and virtual private networks; network intrusion detection; denial of service (DoS) and distributed denial-of-service (DDoS) attacks; DoS and DDoS detection and reaction; worm and virus propagation; tracing the source of attacks; traffic analysis; techniques for hiding the source or destination of network traffic; secure routing protocols; protocol scrubbing; and advanced techniques for reacting to network attacks
Credit 3 units.

T81 INFO 572 Modern Database Concepts & Applications
This course extends basic database concepts to current database issues that impact IS technology. Issues such as data modeling and implementation, dictionaries and repositories, distributed database, legacy systems and reverse engineering, and object orientation will be explored. Hands-on experience with leading database products will be an integral part of the course. A familiarity with basic database concepts and design principles is assumed.
Credit 3 units.

T81 INFO 575 Data Warehousing
This course will introduce students to the major activities involved in data warehousing and its application to a business. The class will concentrate on topics such as: requirements gathering for data warehousing, business constraints, data warehouse technologies and architectures, dimensional model design, entity relationship model design, physical database design for data warehousing, extracting, transforming, and loading strategies, introduction to business intelligence and reporting, expansion and support of a data warehouse. Once the basic principles have been established, the remainder of the class will be built around a group data warehouse project. The project will begin with student groups gathering requirements and developing a data warehouse design. Once the design is complete, students will build a prototype data warehouse containing the necessary structures within their database and populating them with source data. This will require students to develop the table definitions, extract/transform/load (ETL) logic, and example report definitions. We intend this class to be a hands-on example of a simple data warehouse implementation. Focus areas and skills obtained after completion of the course: gather requirements for data warehousing, explain data warehouse technologies and architecture, understand the advantages and disadvantages of both dimensional and ER modeling for data warehousing, identify data sources, design a physical model for data warehousing, comprehend extract, transform and load strategies, design and develop business reports and business considerations for expanding and supporting a data warehouse.
Credit 3 units.

T81 INFO 578 Security Auditing
This course provides information technology (IT) professionals an understanding of how security auditing can be successfully integrated as an important component in an effective organizational cyber security program. The course provides
students practical information to successfully prepare for an internal or external IT audit, use security auditing to reduce risk, and enhance the overall cyber defense environment within their organization. The course provides an overview of the most prevalent types of IT audits affecting organizations, presents a structured methodology for conducting internal audits or preparing for an external audit, and examines challenges and future trends to security auditing brought about by cloud computing, regulatory trends, and other factors. Through the course material, discussions and case studies, students will acquire practical security auditing concepts and principles that can be applied within their organizations to enhance cyber security.
Credit 3 units.

T81 INFO 579 Secure Software Development: Ins and Outs - Building a Secure Information Security Platform
Application security encompasses measures taken throughout the application's life cycle to prevent exceptions in the security policy of an application or the underlying system (vulnerabilities) through flaws in the design, development, deployment, upgrade or maintenance of the application. This course examines the reasons for the inherent complexity of secure software construction, and presents structured methods to deal effectively with it. The course will focus on the object-oriented approach for analysis and design. Students will gain an appreciation of the difference between writing programs and doing secure analysis and design. Problem formulation and decomposition (analysis) and solution building (design) will be covered. Students will work in small groups, each group having the responsibility for secure analysis, design and implementation of a software system. Case tools will be used in several stages of the development process. Open Web Application Security Project (OWASP) and Web Application Security Consortium (WASC) will be discussed. These aid developers, security testers and architects to focus on better design and mitigation strategy.
Credit 3 units.

T81 INFO 581 Top Ten Technologies
Deciding the top ten information-based technologies is the core idea. This includes reviewing appropriate ways of judging a technology as "top," sources of judging criteria, where the technologies may be applied, and important frameworks/laws/rules that contribute to our understanding of technologies in general. Students will participate in a process of discovery and "judgment rationalization" that will lead to producing a list of the top ten technologies. A brief survey of top technologies will also be provided.
Credit 3 units.

T81 INFO 581B Emerging Technologies and Innovation
Understanding the role that new technologies can play in achieving the strategic vision and thus shareholder value of the firm will be the focus of this course. This includes reviewing appropriate ways of judging a technology and whether a repositioned technology can drive business value. Students will participate in a process of discovery and judgment rationalization that will lead to understanding how to bring together the technical and commercial worlds in a profitable way. A discussion of the key concepts that it would take to distinguish between activities and outcomes. Technological innovations (outcomes) are normally the result of product, process, market development and administrative capabilities. A discussion on strategy, visioning, formulation and execution. How does innovation and growth enter into it (innovation and growth innovation in design; interaction with customers; in business processes; in management thinking)? How to build an innovation strategy will be the capstone of the course.
Credit 3 units.

T81 INFO 583 Privacy and Security Law and Ethics
The growth of business models based upon information technology and personal information have spawned numerous legal and ethical issues, and created great uncertainty about the liability that business practices in these areas could create. While there are legal rules governing some aspects of privacy and security, the law lags behind actual practice, and first responsibility for ethical data use often lies with enterprises themselves, which must balance legal and ethical obligations with others including profitability and innovation. This course will provide an overview of the legal and ethical issues surrounding business possession and use of personal data. The course will consist of readings and discussions structured around a series of important topics in this area, including the concept of personally identifiable information, federal privacy laws, privacy by design, the role of the Federal Trade Commission, the role of the chief privacy officer, and data breach notification law.
Credit 1.5 units.

T81 INFO 584 Public Speaking and Presentation Skills for Technical Professionals
More and more, major corporations require their technical staff to have the skills to communicate to other employees and to be able to deliver compelling and succinct presentations. One of the goals of the MIS and MCSM programs is to produce great analytical thinkers. The goal of this course is to create analytical thinkers who are great communicators and can deliver clear, concise, creative and perhaps even entertaining presentations — within a technical setting. In order to bring out their more expressive side, students will learn how to overcome the fear of public speaking and truly communicate with an audience of any size; study techniques actors learn to perfect their ability to think quickly on their feet, including improvisation and storytelling; and learn the keys to great presentations both graphically and auditorially — including advanced PowerPoint skills. Students will be assigned and graded on presentations delivered on a myriad of topics culminating in a final presentation in the student's core area of study, which will be delivered to a panel of business professionals. To put it succinctly: This is the preparation course for your TED© talk.
Credit 3 units.

T81 INFO 585 Cyber Security Capstone
The capstone project is a culmination of a student's prior course work and is taken toward the end of their program. It gives the student the opportunity to utilize the hard-earned knowledge and skills they have developed as an MCSM student in a real-world setting. The project gives them a chance to apply business judgment and cyber security models to current and emerging opportunities as they confront, create and present a comprehensive cyber security plan to a panel of cyber security industry experts. MCSM students can choose to apply their efforts for their capstone experience to the strategic benefit of their current companies, while others may desire to display more of a holistic focus to the capstone, taking advantage of the project to understand different industry issues.
Credit 3 units.
T81 INFO 586 Defensive Forensics/Reverse Software Engineering
This course will cover topics in using what would traditionally be called "hacking" techniques for the purpose of securing your own network. It will explore security architectures and methodologies that will enable a good cyber defense as well as the tools and techniques necessary to test your defense before cyber adversaries do it for you. The course will include hands-on experience in conducting the various types of attacks that are launched against enterprise networks every day. The course will explore proven techniques for successful and effective management, empowering managers to immediately apply what they've been taught in their workplace. Prerequisites: a degree in computer science or electrical engineering (or equivalent), knowledge of TCP/IP, Unix and Windows operating systems. Credit 3 units.

T81 INFO 587 Mobile Security and BYOD
The proportion of mobile devices providing open platform functionality is expected to continue to increase in the future. The openness of these platforms offers significant opportunities to all parts of the mobile ecosystem by delivering the ability for flexible program and service delivery options that may be installed, removed or refreshed multiple times in line with the user's needs and requirements. However, with openness comes responsibility, and unrestricted access to mobile resources and APIs by applications of unknown or untrusted origin could result in damage to the user, the device, the network or all of these. This course will explore how to build and manage suitable security architectures and network precautions. Credit 3 units.

T81 INFO 588 Cryptography
As the world becomes increasingly dependent on digital communications, computing and information, the need for robust cyber security becomes ever more paramount. Within this context, cryptography becomes an indispensable component of any cyber security system. The purpose of this course is to equip cyber security professionals with a firm understanding of cryptographic principles and applications and how cryptography can be used to secure, protect and safeguard the organization's communications and information. Students will survey the history of cryptography, the evolution of cryptographic algorithms including important symmetric and asymmetric approaches, hashing, authentication and digital signatures, mutual trust, public key infrastructure, key management, user authentication, and cryptographic attacks. Particular focus will be placed on the integration of cryptography within the organization's IT infrastructure to include IPSec; email, wireless, and data encryption and how to analyze, support and present the business case for cryptography in the IT enterprise. Note: Although cryptography is a mathematically intense discipline, the course will be taught from a managerial perspective. As such, the course is self-contained mathematically, and students are not required to have an extensive math background, although some college-based course work is recommended. Credit 3 units.

T81 INFO 589 Business Continuity and Disaster Recovery
This comprehensive course provides up-to-date assessments and understanding on issues that will affect you and your company. Issues such as earthquakes, hurricanes, acts of terrorism, communication, cyber security and news media events will be discussed by an expert who has led disaster recovery efforts through most of these events. Students will have the opportunity to interact with experts in these areas and gain practical knowledge about how to respond and deal with large-scale events affecting the enterprise. By the end of this course, the student will have a thorough comprehension of the tools, knowledge and understanding necessary to assess, benchmark and develop a wide-ranging disaster recovery and business continuity program. Credit 3 units.

T81 INFO 591 Research & Research Design for Info. Mgmt.
Both quantitative and qualitative research approaches will be covered. Approaches will include surveys, literature, field studies, human factors and active research. Problems of validity and reliability will be discussed. The course will include a review of current research in information management. Students are expected to design a research project. Credit 3 units.

T81 INFO 591A Research & Research Design for Info. Systems
Both quantitative and qualitative research approaches will be covered. Approaches will include surveys, literature, field studies, human factors and active research. Problems of validity and reliability will be discussed. The course will include a review of current research in information management. Students will be expected to design a research project. Credit variable, maximum 3 units.

T81 INFO 612 Cyber Counterespionage - Case Study Analysis
Students will study the management and the communication of information that could be presented in court or could be used to facilitate other information that would be presented in court. The course will review the federal and certain state laws pertaining to the collection of evidence and evidence-related material and the successful submission of evidence to a court. In addition, strategies will be discussed as related to discovery of evidence and evidence-related material and the use of attorney-client privilege and work product to protect the client's interests with respect to such material. The students will also examine when reports should be drafted and examine the proper drafting and use of such reports as a submission to legal counsel, the court or to business. Further, the students will study effective testimony in a court of law that would include oral testimony and use of demonstrative evidence and material. Credit 3 units.

T81 INFO 614 Security Risk Analysis
This course addresses the tools, techniques and methodologies in performing computer system and network security risk analyses. Computer system and network vulnerabilities will be examined as well as tools designed to discover or exploit them. Security best practices and audit requirements for specific environments will be studied. Topics to be covered include internal and external penetration tests, risk quantification, assessment and analysis methodologies, communicating security risks quantitatively, project loss probability curves, Monte Carlo simulations, and security audits. Measuring uncertainty, risk and the value of information are closely related concepts, important measurements themselves, and precursors to most other measurements. These and other relevant risk analysis benchmarking and analytic assurance techniques will be explored.
Credit 1.5 units.

**T81 INFO 673 Cyber Security Metrics**
This course will provide the student with the principles and perspectives to understand key characteristics of a successful security metrics program. The class will review organizational management issues to ensure partner groups and executive sponsorship supports the effort through active involvement. We will review current business and technical frameworks for selecting and organizing elements of a cyber security metrics program. As well, the course work will include state-of-the-art exercises and case studies in developing real-world solutions to answering executive management's questions: How secure is our organization? Which threats should we assign the highest priority? Where are the organization's weakest points? At the conclusion of the course, the student will understand how a cyber security metrics program can be deployed to introduce continual improvement concepts into an organization with respect to cyber security. Credit 1.5 units.

Credit 3 units.

**T81 INFO 675 Life Cycle Cost Analysis**
This course will introduce the student to the discipline of life cycle cost estimating and analysis with a focus on applying that information to program management decision making, strategy and managing the program team. The course will be a mix of lecture, classroom discussion and example case studies (worked during class time). The majority of the applied mathematics within this course will be demonstrated on the personal computer using Microsoft Excel software. It is strongly recommended that students bring their own laptops (with Microsoft Excel installed) in order to work along with the example cases. Credit 3 units.

**T81 INFO 885 Master's Nonresident**

**T81 INFO 887 Graduate Certificate Nonresident**
For graduate-level students who are seeking only a graduate certificate (i.e., and are not pursuing any master's or doctoral program). Registration into this course is for semesters when the student is nonresident to the university campus, but is still technically actively involved in communications with department and faculty, as needed, to continue certificate program. Fulfills continuous registration requirement.